Domestic Nuclear Detection Office (DNDO)

An Update on the Radiation Portal Monitor Program

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Steve Karoly
Assistant Director
Product Acquisition and Deployment Directorate
Domestic Nuclear Detection Office
Department of Homeland Security
Agenda

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- Background
- Executive Summary
- PVT Improvement
- Service Life Extension Project
- Radiation Portal Monitors Replacement
- Conclusions
Purpose

Brief Nuclear and Radiation Studies Board on the polyvinyl toluene life extension and improvement program and next-generation detector system program activities
Background

- Over 1300 Radiation Portal Monitors (RPM) currently deployed domestically
- Expected Service Life of 10 years, but data indicates potential of 13+ years
- Oldest deployed RPMs are 10 years old
- Current average age of deployed RPMs is 6 years
- Concerns include obsolescence, new technology insertion capacity, sustainability, and performance capabilities of existing systems
- Challenge is to develop additional operational efficiencies and extend life of current systems in a fiscally constrained environment
Executive Summary

- Projects are leveraging National Academy of Sciences (NAS) recommendations to deploy solutions incrementally to support continuous improvement, iteratively refine models using a mix of modeling and testing, and conduct cost/benefit analysis of a wide range of alternatives.

  - **Polyvinyl Toluene (PVT) Improvement Project**
    - Evaluated and filtered through cost/benefit analysis of proposed hardware modifications, different algorithm approaches, and current algorithm parameter settings to improve performance
    - Analyzing most promising alternatives using a mix of modeling and testing
    - Develop incremental market rollout of selected alternative(s) collaboratively with Customs and Border Protection

  - **Service Life Extension Project (SLEP)**
    - Address obsolescence and RPM performance degradation concerns
      - Assessing Technology refresh alternatives in lab and operational settings
      - Implementing Operating System upgrades and system component replacements

  - **RPM Replacement Project**
    - Currently conducting a phased Analysis of Alternatives (AoA) to evaluate replacement alternatives
    - AoA will consider non-materiel and materiel options

All projects follow the DNDO Solution Development Process (SDP), consistent with Department of Homeland Security Acquisition Directive 102-01.
PVT Improvement Project - Summary

- Concepts solicited via Requests for Information (RFI) from industry and national laboratories
- Trade study conducted and documented assessing the technical performance and costs for selected proposals; threat detection efficacy, nuisance alarm rates, implementation costs among factors considered
- Sixteen proposals received in June 2010; seven projects/activities awarded and evaluations completed
  - 4 software-related improvements
  - 1 hardware-related improvement
  - 2 service life/aging studies
- Evaluation of three software-related concepts is continuing
  - Leverages Energy Windowing capabilities of Science Application International Corporation (SAIC) RPM8 system: Threshold Optimization, Energy Windowing Optimization, and Revised Operational Settings
  - Utilizes parameter settings developed from extensive assessment of Stream of Commerce (SOC) data and radionuclide profiles (balancing nuisance alarm reduction and threat detection)
  - Implementation possible through parameter adjustments using deployed RPMs
  - Evaluation leveraging completed modeling, laboratory testing, and field evaluation
Field Evaluation Setup

- Two SAIC Radiation Portal Monitors placed in series for 1 lane at 1 seaport (i.e., lane 2)
  - System of Record RPM (SOR) (current algorithm parameter settings)
  - Data Collection RPM (DCR) (proposed algorithm parameter settings)
- Both systems use Energy Window and Gross Count alarming to different degrees
- Nuisance alarm and detection efficacy performance evaluated for alternative parameter settings
- ~26000 total occupancies analyzed during field evaluation
**Testing and Deploying Improvements**

- Field evaluation of improvements coupled with iterative model refinement being utilized: *
  - Provides basis of comparison with predicted performance
  - Provides basis for refinement of settings to increase robustness in maintaining performance against additional SOC (i.e., lower nuisance alarms) and radionuclide sources (current or improved threat detection)

- Data collected at one seaport terminal performed over ~30 days for each alternative parameter setting approach evaluated (completed 4QFY2013)
  - Scenario 1: SOC measurements – reduction in non-threat alarm rate
  - Scenario 2: Radionuclide source measurements (off-hours) – threat detection sensitivity
  - Alarm reduction results positive, exceeded 50% minimum nuisance alarm rate reduction goal for settings evaluated

- Targeting implementation of one or more approaches in two seaports by Spring 2014 based on evaluation of alternative settings against additional SOC and threat spectra, conduct an operational cost/benefit analysis

*Consistent with NAS recommendation of incremental model development*
Service Life Extension Project (SLEP) - Summary

- Objective: Maintain radiation scanning capability as RPMs approach end of service life
  - Initial estimate of 10 years, but 13-20 years appears possible
  - Will provide time to complete AoA and implement a longer-term replacement solution

- Field experience and market research have identified areas of potential risk of obsolescence

- Near-Term Goals:
  - Develop near-term RPM obsolescence solutions
  - Implement solutions targeting 5+ year life extension for fielded RPM units with performance concerns
  - Conduct studies to inform additional service life extension actions

- SLEP activities are underway: Operating System (OS) upgrade, PVT performance degradation mitigation, and evaluations of technology refresh concepts
**SLEP Activities**

- **Windows OS Upgrade**
  - Issue: OS upgrades to RPM Supervisory Control systems must be implemented to match Windows OS Migration Path (Windows XP support ends April 2014)
  - Action:
    - RPM vendors have delivered software updates for Windows 7 OS upgrade (CY2013)
    - Testing of upgrades and field implementation underway (CY2014)

- **PVT Degradation Mitigation**
  - Issue: PVT degradation has been accelerated in some operating environments
  - Action:
    - Conducted lab analysis to replicate environmental conditions and estimate failure timeframe
    - Implementing replacement of PVT plastics and conducting post-mortem on replaced material (CY2013/CY2014)
    - Initiate pilot to evaluate alternative measures to mitigate performance degradation initiated (CY2013/CY2014)
    - Generate follow-on actions based on findings (CY2014)
SLEP Activities (cont.)

- Technology Refresh System Evaluation
  - Item: Ongoing market research has identified technology concepts that could potentially improve detection and operation performance via upgrades to RPM system components with minimal changes to supporting infrastructure
  - Action:
    - Issue RFIs to collect market research and then Request for Proposals (RFP) to obtain Commercial Off the Shelf equipment (CY2013)
    - Evaluate equipment in laboratory and operational settings (CY2014)
RPM Replacement Project – Summary

- The RPM Replacement Project will evaluate technologies and associated operational capabilities to replace those in the deployed PVT RPMs*
  - Using market research and analytical studies (including findings from PVT Improvement and SLEP projects), a path forward to address the radionuclide detection capability will be provided

- Non-materiel and materiel options will be evaluated*
  - Non-materiel solutions – assesses risk reduction performance trade-offs assuming current funding levels and considers non-materiel solutions such as alternate concept of operations
  - Non-materiel and materiel solutions – assesses risk reduction performance trade-offs assuming program funding increases and that new technologies may be available

*Consistent with NAS recommendation on cost-benefit assessments
RPM Replacement Project – Summary (cont.)

- Independent party, Homeland Security Studies and Analysis Institute, will conduct an Analysis of Alternatives (AoA)
- AoA will be reviewed by a Technical Review Board (TRB) staffed by DHS personnel
- TRB procedures are documented as part of DNDO Solution Development Process and in Technical Reference Guide (draft)
- AoA Projected Timeline:
  - Spring 2014 – Initial findings released
  - Fall 2014 – Full report complete
Conclusions

- National Academy of Sciences recommendations are being incorporated into RPM-related projects at DNDO.
- Significant progress has been made in identifying potential cost-effective and efficient means of improving the deployed PVT-based RPMs.
- Deployment of improved algorithm parameter settings to significantly reduce nuisance alarms is targeted by Spring 2014 in primary scanning RPMs.
- SLEP actions have been initiated to address obsolescence and performance degradation issues in deployed PVT-based RPMs.
- Results from an AoA for RPM Replacement are expected in 2014 (initial findings in the Spring and a full report in the Fall).